

## STATE OF WASHINGTON STATE BUILDING CODE COUNCIL

# Washington State Energy Code Development Standard Energy Code Proposal Form

Log No. <u>071</u>

Code being amended: Commercial Provisions	Residential Provisions
Code Section # <b>R403.5.1</b>	
Brief Description:	

The purpose of a service water heating (SWH) circulation system is to reduce the amount of time required to provide hot water to the furthest fixture. However, controls are needed to minimize circulation pump operation when there is no demand for hot water. This is particularly important in buildings with a central SWH system.

Circulation pumps with electronically commutated motors (ECM) offer energy savings compared to circulation pumps with standard induction motors. This proposal requires ECM motors for SWH circulation pumps in Group R-2 buildings where a central service water heating system serves multiple dwelling units. This aligns with the 2021 WSEC-C requirements.

In addition, this proposal also requires that the system return pipe in a circulation system be a dedicated return pipe versus allowing a cold water pipe to be used as the return. This reduces heat energy loss in the system. An exception is included in this proposal that allow a cold water pipe to be used as the return for a demand recirculation system serving an individual dwelling unit. An additional proposal submitted by ETC removes this exception.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use <u>underline</u> for new text and <del>strikeout</del> for text to be deleted.)

**R403.5.1 Heated water circulation and temperature maintenance systems.** Heated water circulation systems shall be in accordance with Section R403.5.1.1. Heat trace temperature maintenance systems shall be in accordance with Section R403.5.1.2. Automatic controls, temperature sensors and pumps shall be in a location with *access*. Manual controls shall be in a location with *ready access*.

**R403.5.1.1 Circulation systems.** Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be are prohibited. Controls for circulating hot water system pumps shall automatically turn off the circulation pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The controls shall limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).

R403.5.1.1.1 Group R-2 buildings with central service water heating. Where multiple dwelling units are served by a central service water heating distribution system, circulation pumps shall have an electronically commutated motor with a means of adjusting motor speed for system balancing.

**R403.5.**1.1.21 Demand recirculation water systems serving an individual dwelling units. Where installed, demand recirculation water systems shall have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user\_of a fixture, or sensing the flow of hot or tempered water to a fixture fitting or appliance.

EXCEPTION: It is permitted to use a cold water supply pipe for the system return in a demand recirculation water system provided the controls are configured to limit the temperature of the water entering the cold water piping to not greater than 104°F (40°C).

**R403.8 Systems serving multiple dwelling units.** Systems serving multiple dwelling units shall comply with Sections C403 and C404 of the WSEC--Commercial Provisions in lieu of Section R403.

**R403.5.1.2** Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1 or UL 515. Controls for such systems shall automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

Purpose of code change:

	lation system pump	• •	silvery of service not v	water to plumbing lixtures by							
Your amendment m	ust meet one of the fo	ollowing criteria. Selec	t at least one:								
Addresses a critic	Addresses a critical life/safety need.   Consistency with state or federal regulations.										
☐ The amendment clarifies the intent or application of ☐ Addresses a unique character of the state.											
the code.  Corrects errors and omissions.  Addresses a specific state policy or statute.  (Note that energy conservation is a state policy)											
Check the building ty	ypes that would be im	pacted by your code o	change:								
Single family/dup	olex/townhome	Multi-family 4 + s	stories	Institutional							
Multi-family 1 –	3 stories	Commercial / Re	tail	Industrial							
Your name	Lisa Rosenow		Email address	lrosenow@evergreen-tech.net							
Your organization	Evergreen Technolog	gy Consulting	Phone number	360-539-5202							
Other contact name	Click here to enter	text.									

Economic Impact Data Sheet
Is there an economic impact:  \( \sum \) Yes \( \sum \) No
Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants, and businesses. If you answered "No" above, explain your reasoning.
In service water heating systems, circulation pumps with electronically commutated motors (ECM) offer up to 20% annual energy savings compared to circulation pumps with standard induction motors.
Provide your best estimate of the <b>construction cost</b> (or cost savings) of your code change proposal? (See OFM Life Cycle Cost <u>Analysis tool</u> and <u>Instructions;</u> use these <u>Inputs</u> . Webinars on the tool can be found <u>Here</u> and <u>Here</u> )
\$250 extra incremental cost per pump based on manufacturer data
\$Click here to enter text./square foot (For residential projects, also provide \$Click here to enter text./ dwelling unit)
Show calculations here, and list sources for costs/savings, or attach backup data pages
Refer to calculations attached.
Provide your best estimate of the <b>annual energy savings</b> (or additional energy use) for your code change proposal?
Click here to enter text.KWH/ square foot (or) Click here to enter text.KBTU/ square foot
(For residential projects, also provide Click here to enter text.KWH/KBTU / dwelling unit)
Show calculations here, and list sources for energy savings estimates, or attach backup data pages
Refer to calculations attached.
List any <b>code enforcement</b> time for additional plan review or inspections that your proposal will require, in hours per permit application:
No additional enforcement time required.

**Small Business Impact.** Describe economic impacts to small businesses:

Limited impact to standard SWH system installation practices.

Housing Affordability. Describe economic impacts on housing affordability:

Minimal cost impact that provides long term energy cost savings for service water heating, which is a primary use of energy a dwelling unit.

*Other.* Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

<u>Instructions</u>: Send this form as an email attachment, along with any other documentation available, to: <a href="mailto:sbcc@des.wa.gov">sbcc@des.wa.gov</a>. For further information, call the State Building Code Council at 360-407-9255.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

## **Executive Report**

Project Information							
Project:							
Address:							
Company:	Evergreen Technology Consulting						
Contact:	Duane Lewellen						
Contact Phone:							
Contact Email:	Irosenow@evergreen-tech.net						

Key Analysis Var	iables	Building Characteristics				
Study Period (years)	17	Gross (Sq.Ft)	0			
Nominal Discount Rate	3.14%	Useable (Sq.Ft)	0			
Maintenance Escalation	1.00%	Space Efficiency				
Zero Year (Current Year)	2021	Project Phase	0			
Construction Years	ction Years 2		0			

Life Cycle Cost Analysis	BEST								
Alternative	Baseline		Alt. 1		Alt. 2				
Energy Use Intenstity (kBtu/sq.ft)									
1st Construction Costs	\$ 745	\$	993	\$	745				
PV of Capital Costs	\$ 745	\$	993	\$	745				
PV of Maintenance Costs	\$ 750	\$	-	\$	750				
PV of Utility Costs	\$ 585	\$	410	\$	-				
Total Life Cycle Cost (LCC)	\$ 2,080	\$	1,403	\$	1,495				
Net Present Savings (NPS)	N/A	\$	677	\$	585				

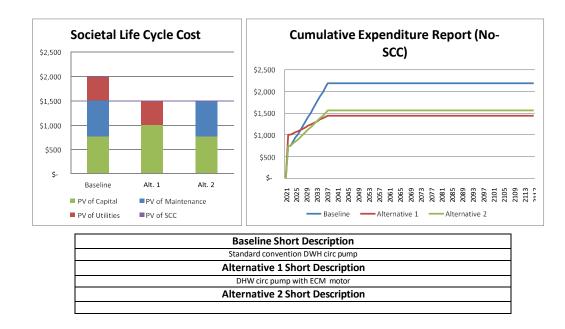
Societal LCC takes into consideration the social cost of carbon dioxide emissions caused by operational energy consumption

(GHG) Social Life Cycle Cost	BEST							
GHG Impact from Utility Consumption	Baseline			Alt. 1		Alt. 2		
Tons of CO2e over Study Period		0		0		0		
% CO2e Reduction vs. Baseline	N/A			30%		0%		
Present Social Cost of Carbon (SCC)	\$ -	LO	\$	7	\$	10		
Total LCC with SCC	\$ 2,09	90	\$	1,410	\$	1,505		
NPS with SCC	N/A		\$	680	\$	585		

Warning: OFM Assigned Variables Not Used

MAJOR ERROR ON:

Alt. 2



Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

## 30-50 kWh/gpm/year

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Click here to enter text.KWH/ square foot (or) Click here to enter text.KBTU/ square foot

(For residential projects, also provide Click here to enter text.KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

LCCT for comparison of domestic hot water circulation pump with PSC type motor to pump with 30% more efficient ECM motor. Assume 4000 hrs/yr pump operation B&G Ecocirc pump = 70 watts input Std Motor Pump=100 watts input 2.5 to 5 GPM at 15 ft/hd

## 30 watts savings X 4000 hrs/yr/1000=120 kWh/yr

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

No additional enforcement time required.







#### IOB: **REPRESENTATIVE:**

UNIT TAG: ORDER NUMBER: DATE: DATE: **ENGINEER:** SUBMITTED BY: CONTRACTOR: APPROVED BY: DATE:



## ecocirc<sup>®</sup> 20-18 | ecocirc+ 20-18

High Efficiency Wet Rotor Circulator with Electronically Commutated Motor (ECM)

#### DESCRIPTION

The ecocirc 20-18 circulators are designed with a highly efficient electronically commutated permanent magnet motor (ECM Technology).

Cast iron flanged models are designed for closed loop hydronic heating and cooling systems, and stainless steel flanged and union body pumps for plumbing systems or open loop heating and cooling systems.

#### **CONSTRUCTION MATERIALS**

Pump Body: Cast Iron or Stainless Steel Impeller: Impact Modified PPE

Shaft: Ceramic/Alumina Rotor Can: 316 Stainless Steel

Bearings: Ceramic/Alumina

O-Ring: EPDM

All Other Wetted Parts: 304 or 316 Stainless Steel

Motor Type: Electronically Commutated Permanent Magnet Motor

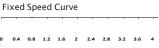
Insulation Class: F

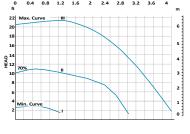
Check Valve: 1" Noryl Check Valve shipped loose for field installation

#### **OPERATING DATA**

Maximum Working Pressure: 145 psi (10 Bar) Minimum Working Temperature:  $14^{\circ}F$  (- $10^{\circ}C$ ) Maximum Working Temperature: 230°F (110°C) Ambient Temperature Range: 32°F - 104°F (0°C - 40°C)

#### **PERFORMANCE**

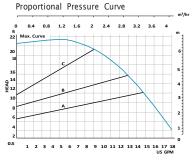






Constant Pressure Curve





#### **SCHEDULE ecocirc 20-18**

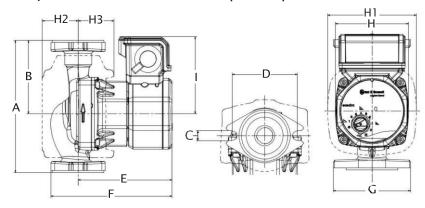
CAST IRON BO	DDY (Flanged)	STAINLESS STEEL BODY (	Flanged and Union)	RATED MOTOR CHARACTERISTICS						
MODEL NUMBER	PART NUMBER	MODEL NUMBER PART NUMBE		VOLTAGE	PHASE	Hz	WATTS RANGE	AMP RANGE		
ecocirc 20-18 flanged	60B0B1000	ecocirc 20-18 stainless steel flanged	60B0B1001	115V	1	50/60	0-70	.06-1.02		
		ecocirc 20-18 stainless steel union	608081002		1	50/60	0-70	.06-1.02		

Note: Where potable water is pumped, use a stainless steel circulator. ecocirc 20-18 and ecocirc+ 20-18 circulators are recommended for indoor use only.

#### SCHEDULE ecocirc+ 20-18

CAST IRON BO	DDY (Flanged)	STAINLESS STEEL BODY (	Flanged and Union)	RATED MOTOR CHARACTERISTICS						
MODEL NUMBER	PART NUMBER	MODEL NUMBER	PART NUMBER	VOLTAGE	PHASE	Hz	WATTS RANGE	AMP RANGE		
ecocirc+ 20-18 flanged	60B0B1003	ecocirc+ 20-18 stainless steel flanged	60B0B1004	115V	1	50/60	0-70	.06-1.02		
		ecocirc+ 20-18 stainless steel union	608081005		1	50/60	0-70	.06-1.02		

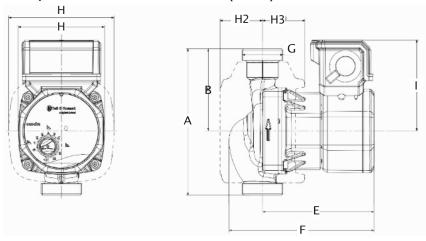
## ecocirc/ecocirc+ 20-18 PUMP DIMENSIONS (FLANGED)



		DIMENSIONS - INCHES (mm)											
MODEL NUMBER	Α	В	E	F	н	H1	H2	НЗ	-	CAST IRON	STAINLESS STEEL		
ecocirc 20-18 flanged	6.38" (162)	3.54" (90)	4.57" (116)	5.9" (150)	3.54" (90)	4.29" (109)	1.73" (44)	1.73" (44)	3.74" (95)	6.2 lb. (2.81)	5.86 lb. (2.66)		
ecocirc+ 20-18 flanged	6.38" (162)	3.54" (90)	4.57" (116)	5.9" (150)	3.54" (90)	4.29" (109)	1.73" (44)	1.73" (44)	3.74" (95)	6.2 lb. (2.81)	5.86 lb. (2.66)		

MODEL NUMBER	FLANGED	# OF	DIMI	ENSIONS – INCHES (n	nm)	COMPANION FL	ANGE PART NUMBERS
	SIZE INCHES - NPT	BOLTS	С	D	G	CAST IRON PN	STAINLESS STEEL PN
ecocirc 20-18 flanged	3/4", 1", 1-1/4", 1-½"	2	.47" (12)	3.15" (80)	3.74" (95)	101201-101204	101501LF - 101504LF
ecocirc+ 20-18 flanged	3/4", 1", 1-1/4", 1-½"	2	.47" (12)	3.15" (80)	3.74" (95)	101201-101204	101501LF - 101504LF

## ecocirc/ecocirc+ 20-18 PUMP DIMENSIONS (UNION)



MODEL NUMBER		DIMENSIONS - INCHES (mm)										
	Α	В	E	F	н	Н1	H2	НЗ	_	CAST IRON	STAINLESS STEEL	
ecocirc 20-18 union	6" (152.4)	3.36" (85.4)	4.57" (116)	5.9" (150)	3.54" (90)	4.29" (109)	1.73" (44)	1.73" (44)	3.74" (95)	N/A	4.61 lb. (2.09)	
ecocirc+ 20-18 union	6" (152)	3.36" (85.4)	4.57" (116)	5.9" (150)	3.54" (90)	4.29" (109)	1.73" (44)	1.73" (44)	3.74" (95)	N/A	4.61 lb. (2.09)	

MODEL NUMBER	UNION TAILPIECE SIZE INCHES – NPT	# OF BOLTS	DIMENSIONS - INCHES (mm)		UNION CONNECTOR KIT PART NUMBERS
			G	CAST IRON PN	BRONZE PN
ecocirc 20-18 union	½" Sweat, 3/4" Sweat, 3/4" NPT	0	1 1/4" NPSM	N/A	113203LF, 113201LF, 113202LF
ecocirc+ 20-18 union	½" Sweat, 3/4" Sweat, 3/4" NPT	0	1 1/4" NPSM	N/A	113203LF, 113201LF, 113202LF

#### SAFETY STANDARDS AND PROTECTION

**Enclosure:** Class 1, IP44 (equivalent to NEMA Type 2) UL Listed to UL 778; UL 1004-1, 1004-7; and UL 60730-1

cUL Listed to C22.2 #108

Electronically Thermally Protected (Integrated Motor Protection)

Motor Insulation Class: F

Stainless steel models are NSF/ANSI-61 certified

#### STANDARD OPERATING MODES



#### CONSTANT SPEED



The pump maintains a constant speed at any flow rate. The desired speed is set on the interface panel of the pump.



#### CONSTANT PRESSURE ( $\Delta p$ -c)



The pump maintains a constant differential pressure at any flow demand until the maximum speed is reached. The desired head of the pump can be set via user interface. Recommended for use in systems with small or constant pressure losses.



#### PROPORTIONAL PRESSURE (Ap-v)



The differential pressure continuously increases or deceases based on the flow demand. The set point head can be set on the pump user interface. Use for systems with large pressure losses.



### NIGHT MODE (ecocirc+ 20-18 only)

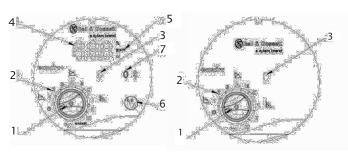
The pump will automatically reduce speed when there is an abrupt change in fluid temperature. The change in fluid temperature is from a boiler operating in night time setback mode. The external temperature sensor is used. (Fixed Speed, Constant Pressure, Proportional Pressure)

#### INPUT SIGNALS (ecocirc+ 20-18 only)

One 0-10V (Analog): Speed Control by external controller

One external temperature sensor input for temperature modes. Sensor Type: KYT38, P/N: 104502

#### ONBOARD USER INTERFACE



1	Control mode knob		
2	Control mode indicators		
3	Status/Fault indicators		
4	Numeric display		
5	Parameter indicators		
6	Control mode button		
7	Remote control status indicator		

#### **TEMPERATURE DEPENDENT OPERATING MODES (ecocirc+ 20-18 only)**

#### SET POINT TEMPERATURE (Δp-T) (ecocirc+ 20-18 only)



The nominal differential pressure set point is modified based on the fluid temperature. Uses an external temperature sensor.

#### SET POINT TEMPERATURE (T) (ecocirc+ 20-18 only)



The pump maintains a constant temperature in a system, such as domestic hot water system or a single temperature heating system. Uses an external temperature sensor.

#### eAdapt (ecocirc+ 20-18 only)

The pump will optimize the energy consumption by identifying the ideal duty point.

### **←**∴ Air Purge

Air purge will remove the dissolved gases from the pump.



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